May 21, 2004

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555

Point Beach Nuclear Plant, Unit 1
Docket 50-266
License No. DPR-24
NRC Order EA-03-009 Relaxation Request Supplement 3

References:
1) Letter from NMC to NRC dated May 14, 2004 (NRC 2004-0052)
2) Letter from NMC to NRC dated March 30, 2004 (NRC 2004-0031)
3) NRC Order EA-03-009, "Issuance of First Revised Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004
4) Letter from NMC to NRC dated May 15, 2004 (NRC 2004-0054)

In references 1 and 2, Nuclear Management Company, LLC (NMC), requested relaxation from certain requirements of Nuclear Regulatory Commission (NRC) Order EA-03-009 (reference 3), for the Point Beach Nuclear Plant (PBNP), Unit 1. Reference 4 provided supplemental information in support of the requested relaxation.

Subsequent to those submittals, NMC was able to perform additional actions such that full compliance with reference 3 was able to be achieved on Nozzle 33. Therefore, NMC hereby requests withdrawal of those portions of the relaxation request pertaining to Nozzle 33, as submitted in references 1, 2 and 4.

The balance of the relaxation request remains in effect.

During conference calls between NMC representatives and NRC staff on May 18, 19 and 20, 2004, the staff requested additional information in support of their review of references 1, 2 and 4. Enclosures I and II to this letter contain the NMC's response to the staff's questions.

A101

This letter contains one new commitment as stated in enclosure I.

Gary D. Van Middlesworth
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosure:

I Response to Request for Additional Information
II Stress Tables for PBNP Unit 1 Reactor Vessel Closure Head Penetrations

cc: Regional Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
NRC Resident Inspector, Point Beach Nuclear Plant
PSCW

ENCLOSURE I

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
NRC ORDER EA-03-009 RELAXATION REQUEST SUPPLEMENT 3

POINT BEACH NUCLEAR PLANT, UNIT 1

REQUEST FOR ADDITIONAL INFORMATION

During conference calls between NMC representatives and NRC staff on May 18, 19 and 20, 2004, the staff requested additional information in support of their review of references 1, 2 and 4, to clarify the portion of the submittal regarding the limited examination distance below the J-groove nozzle weld. The response to the staff's questions are provided below.

FULL EXAMINATION OF NOZZLE 33

NMC took additional action to remove the thermal sleeve on Nozzle 33 to perform an ultrasonic test (UT) examination of all areas that previously lacked full coverage. No indications were detected on nozzle 33 during this exam.

Full compliance with the Order (reference 3) was achieved on Nozzle 33. Therefore, NMC requests withdrawal of those portions of the relaxation request pertaining to Nozzle 33, as submitted in references 1, 2 and 4 (refer to Table 1 of enclosure I in reference 1).

NRC Question 1

The request states that "UT of the most highly stressed portion of the nozzle (the weld heat affected zone) is unaffected by this limitation." Provide tabular listings or graphs of the maximum stresses in the cross-section from the top of the J-groove weld region to the nozzle end for a range of nozzle angles. Indicate the location of the weld on these graphs.

NMC Response

Enclosure II provides tables of the maximum stresses in the cross-section from the top of the J-groove weld region to the nozzle end for a range of nozzle angles (downhill side). The J-groove weld is identified in the tables.

NRC Question 2

Does the structural integrity evaluation use the crack-growth formula in industry report MRP-55? The staff has not made a determination on the subject industry report. Therefore, if using MRP-55, agree to and document the following condition:

> If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during the current operating cycle, the licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this cycle for RPV head penetrations must be based on an acceptable crack growth rate formula.

NMC Response

NMC used the crack-growth formula in industry report MRP-55 as a basis for justifying relaxation from the Order. Therefore, NMC commits to the following:

> If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, NMC shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs NMC of an NRC-approved crack growth formula. If NMC's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and NMC shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during the current operating cycle, NMC shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this cycle for RPV head penetrations must be based on an acceptable crack growth rate formula.

NMC plans to replace the Unit 1 RVCH at the completion of the current operating cycle. Therefore, Order relaxation is requested only for the current Unit 1 operating cycle.

<u>NRC Question 3</u>

What is the initial flaw size (depth and length) for the flaw tolerance evaluation calculations. Discuss the basis for the initial flaw size. In addition, provide a basis for the conclusion that calculations based on nozzle 20 are bounding for the other 16 nozzles that did not receive a minimum examination of one inch below the weld. What are the stresses for the 17 nozzles at the lowest examined distance. Provide the following information regarding figures 1-7 of the Structural Integrity Associates (SIA) calculation PBCH-9Q-310, Rev. 1:

1) indicate the location of the weld;
2) what is meant by reference to the "top";

3) what is the "OD node";
4) what do the values of the x-axis represent?

NMC Response

Initial Flaw Size

The initial flaw depth used in the flaw tolerance evaluation is through-wall. The length of the assumed flaw is from the bottom of the nozzle and extends to the end of the coverage zone (OD surface). The maximum uncovered area is a function of the Areva blade tool and is fixed at 0.4 inch. The length of the assumed flaw is therefore 0.4 inch.

Assessment of the Bounding Case – Nozzle 20

Nozzle 20 has the smallest area of coverage (0.41 inch) and is located in the 30.0° penetration ring. An additional assessment of this limiting dimension (0.41 inch) occurring in the other PBNP nozzle rings was performed. The result of this evaluation concludes that the 30.0° penetration ring bounds all other rings. Figures 6-10 through 6-12 and 6-14 through 6-16 of WCAP-14000 describe crack growth predictions for axial flaws located in the other nozzle rings and were used in this assessment. The 30.0° penetration ring provides the most conservative results (i.e., shortest time for a flaw to reach the J-groove weld) for the area of coverage of 0.41 inch. Nozzle 20 is the bounding nozzle for the flaw tolerance evaluation because it has the smallest area of coverage below the weld and is located in the 30.0° penetration ring.

Nozzle Stresses at the Lowest Examined Distance

Enclosure II of the May 14th submittal (reference 1) details the minimum coverage distance achieved below the J-groove weld for each nozzle. Enclosure II of this submittal includes tables that detail the maximum stresses in the cross-section of the CRDM tubes for a range of nozzle angles. Additionally, Enclosure IV of reference 1 has graphs of the OD and OD stresses for a range of nozzles. The nozzle stresses at the lowest examined distance are contained in these documents.

SIA Assessment of Nozzle Stresses (PBCH-9Q-310 Rev. 1)

Each figure of SIA calculation PBCH-9Q-310 contains two curves. One curve is of the CRDM nozzle OD hoop stress (y-axis) below the J-groove weld, versus nozzle height (x-axis). The other curve is for CRDM nozzle ID hoop stresses (y-axis) below the J-groove weld, versus nozzle height (x-axis). Each curve starts at the bottom of the CRDM nozzle and extends to the toe of the J-groove weld. Stresses in the J-groove weld region of the CRDM nozzle are not shown on the figures but are shown in Enclosure II of this submittal.

Each figure of SIA Calculation PBCH-9Q-310 references the toe of the J-groove weld as the "OD Node." This OD Node location is the same as the "toe of the J-groove weld" shown in Figure IV-2 of NRC Order EA-03-009 (reference 3).

The x-axes of the figures are the height in inches of the CRDM nozzles from a datum. The datum is the center point of an assumed spherical dome that encompasses the dome of the RPV head. This reference point is approximately 8 inches below the RPV flange. Each figure has two locations marked. The first of these markings identifies where the nozzle hoop stress passes below 20 ksi. The second marking identifies what the nozzle hoop stress is at 1 inch below the toe of the J-groove weld (labeled "OD Node").

NRC Question 4

Provide additional technical discussion of the basis for the K factor of 55 Ksi representing a conservative value.

NMC Response

As stated in reference 1, a deterministic flaw tolerance evaluation was performed to justify the acceptability of the unscanned areas. The evaluation was performed for the limiting nozzle, number 20. This evaluation used plant specific crack growth rate (CGR) data from EPRI MRP-55, "Materials Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick-Wall Alloy 600 Material." The growth rate used was $1.98 \times 10^{-03} (K-K_{th})^{1.16}$ inch per year with a value of 55 ksi-$(in)^{0.5}$ for $K-K_{th}$.

This K-independent method of flaw evaluation is considered conservative based on the actual stresses in the nozzle wall. Calculation results using this simplifying assumption were demonstrated as being conservative through comparison to calculations using more advanced finite element models.

WCAP-14000, Revision 1 "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Point Beach Units 1 and 2 (Proprietary)" includes the finite element analysis of this flaw growth. As detailed in the May 15th submittal (reference 4), a separate calculation was performed of the worst-case flaw growth in the small distance below the toe of the J-groove (on the downhill side). Accounting for instrument uncertainty, this worst-case dimension was 0.41 inch.

Figure 6-13 of WCAP-14000 was used. This figure is a crack growth prediction for through-wall axial flaws located in the 30.0° penetration ring. Nozzle 20 is the limiting nozzle for this assessment and is located in the 30.0° penetration ring. The calculation demonstrated that the assumed through-wall flaw would take over 2.5 EFPY to reach the J-groove weld.

As stated in reference 1, initial calculations using plant specific MRP-55 crack growth rate (CGR) data of $1.98 \times 10^{-03} (K-K_{th})^{1.16}$ inch per year and a value of 55 ksi-$(in)^{0.5}$ for $K-K_{th}$, yielded a crack growth rate of 0.207 inch/year. Using this methodology, the assumed through-wall flaw would take 2.0 EFPY to reach the J-groove weld. This is conservative when compared with the 2.5 EFPY prediction above. Therefore use of 55 ksi-$(in)^{0.5}$ in MRP-55 crack growth rate calculations is considered conservative.

ENCLOSURE II

STRESS TABLES FOR PBNP UNIT 1 REACTOR VESSEL CLOSURE HEAD PENETRATIONS

NRC ORDER EA-03-009 RELAXATION REQUEST SUPPLEMENT 3

POINT BEACH NUCLEAR PLANT, UNIT 1

Maximum Stress (Hoop or Axial) vs Elevation

0° Nozzle
(axisymmetric, no downhill or uphill)

	Height, in.	Stress, ksi
Weld Top	3.06	58.51
	2.89	53.38
	2.71	58.77
	2.54	67.91
	2.37	73.16
	2.19	74.51
	2.02	76.26
	1.84	73.49
Weld Bottom	1.67	64.47
	1.52	58.78
	1.33	56.83
	1.10	51.59
	0.81	34.28
	0.45	15.97
Nozzle Bottom	0.00	5.41

9° CRDM Nozzle Geometry

	Downhill		Uphill	
	Height, in.	Stress, ksi	Height, in.	Stress, ksi
Weld Top	3.08	56.01	3.75	59.32
	2.91	52.05	3.56	56.79
	2.74	52.56	3.38	65.38
	2.57	62.04	3.20	74.69
	2.40	70.96	3.01	75.56
	2.23	74.50	2.83	75.41
	2.06	79.25	2.64	71.84
	1.88	77.20	2.46	69.02
Weld Bottom	1.71	67.17	2.28	59.19
	1.56	58.59	2.07	59.13
	1.37	52.65	1.82	54.73
	1.13	45.98	1.50	47.78
	0.83	29.90	1.11	39.52
	0.46	16.37	0.61	19.51
Nozzle Bottom	0.00	6.84	0.00	6.29

28° CRDM Nozzle Geometry

	Downhill		Uphill	
	Height, in.	Stress, ksi	Height, in.	Stress, ksi
Weld Top	3.22	59.70	5.32	74.73
	3.04	58.20	5.12	67.98
	2.86	54.97	4.93	72.94
	2.68	53.38	4.73	78.28
	2.50	64.01	4.54	75.18
	2.32	66.73	4.34	72.19
	2.14	84.85	4.15	72.75
	1.96	89.30	3.95	72.32
Weld Bottom	1.78	87.28	3.76	63.49
	1.62	62.30	3.42	64.04
	1.42	47.71	3.00	55.04
	1.18	33.86	2.48	50.72
	0.87	24.88	1.83	32.76
	0.48	15.48	1.02	10.91
Nozzle Bottom	0.00	6.02	0.00	0.01

43° CRDM Nozzle Geometry

	Downhill		Uphill	
	Height, in.	Stress, ksi	Height, in.	Stress, ksi
Weld Top	3.48	64.87	7.16	73.65
	3.26	65.10	6.93	71.22
	3.04	66.79	6.69	75.87
	2.82	60.07	6.46	78.11
	2.61	55.05	6.22	77.09
	2.39	61.46	5.98	75.89
	2.17	83.24	5.75	76.62
	1.96	89.55	5.51	74.34
Weld Bottom	1.74	103.54	5.28	68.94
	1.58	72.19	4.81	64.79
	1.39	44.40	4.22	59.34
	1.15	29.24	3.48	49.87
	0.85	18.40	2.57	27.20
	0.47	13.68	1.43	5.73
Nozzle Bottom	0.00	7.27	0.00	5.57